PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No.	: 10/553,588
Applicant	: Shigeki Imafuku et al
Filed	: October 17, 2005
Patent No.	: 7,337,533
Issue Date	: March 4, 2008
Title	: DEVICE AND METHOD FOR MOUNTING PART
Conf. No.	: 1501
TC/A.U.	: 3729
Examiner	: Carl J. Arbes
Customer No.	: 52054
Docket No.	: NGB - 38837

CERTIFICATE OF CORRECTION TRANSMITTAL LETTER

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Sir:

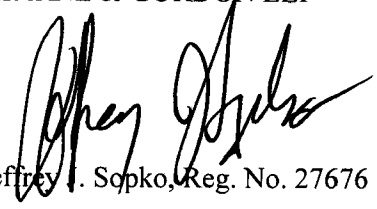
A Certificate of Correction under 35 U.S.C. 254 is hereby requested to correct Patent Office printing errors in the above-identified patent. Enclosed herewith is a proposed Certificate of Correction (Form No. PTO-1050) for consideration. Also enclosed is documentation in support of this request.

It is requested that the Certificate of Correction be completed and mailed at an early date to the undersigned attorney of record. The proposed corrections are obvious ones and do not in any way change the sense of the application.

We understand that a payment is not required since the errors were on the part of the Patent and Trademark Office in printing the patent.

Respectfully submitted,

PEARNE & GORDON LLP



Jeffrey J. Sopko, Reg. No. 27676

1801 East 9th Street, Suite 1200
Cleveland, OH 44114
(216) 579-1700

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(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,337,533

APPLICATION NO.: 10/553,588

ISSUE DATE : March 4, 2008

INVENTOR(S) : Shigeki Imafuku et al

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In column 2, line 36, please delete "<". The line should read --- 11-330786/(1999) ---

In column 9, line 2, please delete "claim 2, 3, 4 or 5 can be satisfied." and insert therefor --- the claims can be satisfied. ---

In column 9, line 41, please delete "and a (a designates a margin to be added for avoiding" and insert therefor --- and α (α designates a margin to be added for avoiding ---

MAILING ADDRESS OF SENDER (Please do not use customer number below):

PEARNE & GORDON LLP
1801 East 9th Street
Suite 1200
Cleveland, OH 44114

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for moving the nozzle at the time of mounting the component so that it is possible to improve the production efficiency.

Please replace the paragraph on page 8, lines 4-9, with the following amended paragraph.

According to ~~Claims 1, 2 and 8~~the claims, it is possible to move down the nozzle in accordance with the height and position of each obstacle while overlapping with the obstacle when the nozzle is to be moved from the component supply portion to the board. Accordingly, when the nozzle has arrived at the mounting point above the board, the height of the nozzle can be set at a required minimum value so that the elevating stroke of the nozzle at the time of mounting the component becomes shortest.

Please replace the paragraph on page12, lines 10-14, with the following amended paragraph.

The obstacle list may be registered into the computer by a person, or may be registered based on automatic measurement of the board camera etc. When only the conveyance rail, the nozzle station, the component camera or the referenced mark is registered in this obstacle list, requirements of

disposed respectively in required positions and at required heights, but not allowed to be moved easily in order to ensure accuracy. Accordingly, a height high enough not to interfere with each of these obstacles (the component camera, the nozzle station, the reference mark, and the conveyance rail) has to be ensured as the height with which the nozzle 55 moves.

(Patent Document 1) Japanese Patent Publication JP-A-9-214182/(1997)

(Patent Document 2) Japanese Patent Publication JP-A- 2002-111284

(Patent Document 3) Japanese Patent Publication JP-A-

<Disclosure of the Invention>

In the aforementioned configuration, the nozzle 55 is moved while a height high enough not to interfere with each of the obstacles (the component camera, the nozzle station, the reference mark, the conveyance rail, etc.) is ensured as the height with which the nozzle moves. Even after the nozzle 55 has reached above the board, the nozzle 55 still moves at the same height. For this reason, when the nozzle 55 having arrived above a component mounting position on the circuit board is to mount the component, an elevating stroke of the nozzle 55 is so large that the production efficiency is lowered.

As shown in Fig. 13, a moving trajectory of the nozzle 55 at the time of mounting a component is as follows. The nozzle 55 is moved horizontally at a fixed height with a component height being set at Ha ((1) in Fig. 13). As soon as the nozzle 55 has reached just above a component mounting position P0, the nozzle 55 is stopped from moving horizontally and is moved down vertically by a height ΔH ((2) in Fig. 13) so as to mount the electronic component on the board 58. After that, the nozzle 55 is moved up vertically ((3) in Fig. 13). As soon as the nozzle 55 has reached a predetermined height, the nozzle 55 is stopped from moving up but is made to start to move horizontally ((4) in Fig. 13). To this end, times are required respectively for the horizontal movement operation and the elevating operation of the nozzle 55. Therefore, the operation time becomes so long that the production efficiency is lowered.

The present invention is to solve the foregoing problems. An object of the present invention is to provide a component mounting apparatus and a component mounting method in which time to move a nozzle can be shortened so that production efficiency can be improved.

effective.

In Step 6, the obstacle list shown in Fig. 3(a) by way of example is searched to find a highest one of the obstacles located between the current position of the nozzle and the position of the circuit board. In the case of Fig. 3(a), the nozzle station with the identification code B is the highest. Incidentally, in this search, obstacles out of a movement path of the nozzle may be excluded from the search. In order to simplify the processing, all the obstacles may be intended for the search. In Step 7, the nozzle is moved up to a height equal to a sum of a height (the largest height of the obstacle)

In Step 8, horizontal movement of the nozzle toward the circuit board is started. In Step 9, it is determined whether the nozzle has finished passing over the obstacle A or not while X- and Y-coordinate positions of the nozzle are monitored. When it is concluded that the nozzle has finished passing over the obstacle A, the routine of processing advances to a next step. The X and Y coordinates of the nozzle can be obtained as follows. For example, when the motors are servo motors, the X and Y coordinates of the nozzle can be read from encoders attached to the motors. When the motors are pulse motors, the X and Y coordinates of the nozzle can be obtained by counting pulses given to the motors. In Step 10, the current height of the nozzle is compared with a sum of the height of an obstacle (largest height of the obstacles B to D) the nozzle will pass over, and α. Here, only when the nozzle is higher, the routine of processing goes to Step 11, in which the nozzle is moved down to the height equal to the sum of (the largest height of the obstacles B to D) and α.

Incidentally, when the obstacle A is out of the movement path of the nozzle, Steps 9 to 11 does not have to be executed. For the sake of simplification of the processing, Steps 9 to 11 may be executed whether the obstacle A is out of the movement path of the nozzle or not. In Step 12, it is determined whether the nozzle has finished passing over the obstacle B or not while the X- and Y-coordinate positions of the nozzle are monitored. When it is concluded that the nozzle has finished passing over the obstacle B, the routine of processing advances to a next step.

In Step 13, the current height of the nozzle is compared with a sum of the height of an obstacle the nozzle will pass over (largest height of the obstacles C to D), and α. Here, only when the nozzle is higher, the routine of processing goes to Step 14, in which